

## Low-volume high-intensity interval training enhances muscular power as well as cardiorespiratory fitness

Fergal M Grace<sup>1</sup>, Nicholas Sculthorpe<sup>1</sup>, Kathryn L Weston<sup>2</sup> and Matthew Weston<sup>3</sup>

<sup>1</sup>Institute of Clinical Exercise & Health Sciences, University of the West of Scotland, Hamilton, South Lanarkshire, UK

<sup>2</sup>Health and Social Care Institute, Teesside University, Middlesbrough, UK

<sup>3</sup>Department of Sport & Exercise Sciences, School of Social Sciences, Business & Law, Teesside University, Middlesbrough, UK

In rebutting Wisloff et al., Holloway and Spriet (2015) caution against forgoing activities such as resistance training for health benefit. Indeed, it is increasingly evident that maintaining muscle power and cardiorespiratory fitness (CRF) are arguably the most effective secondary prevention strategies individuals can undertake during advancing age. For instance, each 1-MET improvement in CRF equates to ~10-25% reduction in mortality risk (Kaminsky et al. 2013) and muscle power better predicts future frailty and loss of independence than strength (Reid & Fielding, 2013). Wisloff et al. (2015) reported that the majority of clinical studies examining HIIT employ intensities ranging between 80-100%HR<sub>max</sub> rather than *low-volume* HIIT, performed supra-maximally (e.g. ‘all-out’), yet benefits of the latter include simultaneous improvements in CRF, power and functional power (e.g. get-up-and-go test) (Cantrell et al., 2014; Buckley et al., 2015; Adamson et al., 2014) for a lower exercise time commitment. For example, 3 min of low-volume HIIT, performed every 5 days increases CRF (Grace et al., 2015) and muscular power (Sculthorpe et al. 2015) in sedentary ageing men, more so than is observed amongst younger cohorts (Weston et al., 2014). Furthermore, time-efficient training is of pertinence to pre-surgical patients as rapid improvements in pre-operative CRF lessens surgical risk and facilitates recovery (Valkenet et al., 2011; Singh et al., 2014; Weston et al., 2016). As such, we firmly believe it is prudent to further our understanding of the potential wide-ranging health benefits of different forms of HIIT before its role in risk reduction and disease treatment is downplayed.

### References

1. Adamson SB, Lorimer R, Cogley JN, Babraj JA. Extremely Short-Duration High-Intensity Training Substantially Improves the Physical Function and Self-Reported Health Status of Elderly Adults. *Journal of the American Geriatrics Society*. 2014;62(7):1380-1381. doi:10.1111/jgs.12916.
2. Buckley S, Knapp K, Lackie A, et al. Multimodal high-intensity interval training increases muscle function and metabolic performance in females. *Appl Physiol Nutr Metab*. 2015;40(11):1157-1162. doi:10.1139/apnm-2015-0238.
3. Cantrell GS, Schilling BK, Paquette MR, Murlasits Z. Maximal strength, power, and aerobic endurance adaptations to concurrent strength and sprint interval training. *Eur J Appl Physiol*. 2014;114(4):763-771. doi:10.1007/s00421-013-2811-8.
4. Grace FM, Herbert P, Ratcliffe JW, New KJ, Baker JS, Sculthorpe NF. Age related vascular endothelial function following lifelong sedentariness: positive impact of cardiovascular conditioning without further improvement following low frequency high intensity interval training. *Physiological Reports*. 2015;3(1):e12234-e12234. doi:10.14814/phy2.12234.
5. Holloway TM, Spriet LL. Crosstalk Opposing View: High intensity interval training does not have a role in risk reduction or treatment of disease. *The Journal of Physiology*. December 2015:n/a–n/a. doi:10.1113/JP271039.

6. Kaminsky LA, Arena R, Beckie TM, Brubaker PH, Church TS, Forman DE, Franklin BA, Gulati M, Lavie CJ, Myers J, Patel MJ, Pina IL, Weintraub WS, and Williams MA. The importance of cardiorespiratory fitness in the United States: the need for a national registry: a policy statement from the American Heart Association. *Circulation* 127: 652-662, 2013.
7. Reid KF, and Fielding RA. Skeletal Muscle Power: A Critical Determinant of Physical Functioning in Older Adults. *Exercise and Sport Sciences Reviews* 40: 4-12, 2012
8. Sculthorpe N, Herbert P, Grace FM. Low-Frequency High-Intensity Interval Training is an Effective Method to Improve Muscle Power in Lifelong Sedentary Aging Men: A Randomized Controlled Trial. *Journal of the American Geriatrics Society*. 2015;63(11):2412-2413. doi:10.1111/jgs.13863.
9. Singh F, Newton RU, Galvão DA, Spry N, Baker MK. A systematic review of pre-surgical exercise intervention studies with cancer patients. *Surgical Oncology*. 2013;22(2):92-104. doi:10.1016/j.suronc.2013.01.004.
10. Valkenet K, van de Port IG, Dronkers JJ, de Vries WR, Lindeman E, Backx FJ. The effects of preoperative exercise therapy on postoperative outcome: a systematic review. *Clinical Rehabilitation*. 2011;25(2):99-111. doi:10.1177/0269215510380830.
11. Weston M, Taylor KL, Batterham AM, Hopkins WG. Effects of low-volume high-intensity interval training (HIT) on fitness in adults: a meta-analysis of controlled and non-controlled trials. *Sports Med*. 2014;44(7):1005-1017. doi:10.1007/s40279-014-0180-z.
12. Weston M, Weston KL, Prentis J, Snowden CP. High-Intensity Interval Training (HIT) for Effective and Time-Efficient Pre-Surgical Exercise Interventions. *Perioperative Medicine*. 2016. doi:10.1186/s13741-015-0026-8.
13. Wisløff U, Coombes JS, Rognmo Ø. High intensity interval training does have a role in risk reduction or treatment of disease. *The Journal of Physiology*. December 2015:n/a–n/a. doi:10.1113/JP271041.